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| Name: Kristy Jones and Miranda Strunk                                                               Date: April 9, 2015 Lesson Title: Force and Motion  Grade Level: 4th Grade  Length of Lesson (Minutes): 138 | | |
| **Standards** | | |
| **Science**  GLE 0407.11.3 Investigate the relationship between the speed of an object and the distance traveled during a certain time period.  GLE 0407.Inq.1  Explore different scientific phenomena by asking questions, making logical predictions, planning investigations, and recording data.  GLE 0407.T/E.1 Describe how tools, technology, and inventions help to answer questions and solve problems.  SPI 0407.11.1 Describe the position of an object relative to fixed reference points.  SPI 0407.11.2 Identify factors that influence the motion of an object.  SPI 0407.11.3 Determine the relationship between speed and distance traveled overtime.  **Math**  [CCSS.Math.Content.4.NBT.B.4](http://www.corestandards.org/Math/Content/4/NBT/B/4/) Fluently add and subtract multi-digit whole numbers using the standard algorithm.  [CCSS.Math.Content.4.MD.A.1](http://www.corestandards.org/Math/Content/4/MD/A/1/) Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), …*  **Writing**  [CCSS.ELA-Literacy.W.4.1](http://www.corestandards.org/ELA-Literacy/W/4/1/) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.  [CCSS.ELA-Literacy.W.4.1.a](http://www.corestandards.org/ELA-Literacy/W/4/1/a/) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which related ideas are grouped to support the writer's purpose.  [CCSS.ELA-Literacy.W.4.1.b](http://www.corestandards.org/ELA-Literacy/W/4/1/b/) Provide reasons that are supported by facts and details.  [CCSS.ELA-Literacy.W.4.1.c](http://www.corestandards.org/ELA-Literacy/W/4/1/c/) Link opinion and reasons using words and phrases (e.g., *for instance*, *in order to*, *in addition*).  [CCSS.ELA-Literacy.W.4.1.d](http://www.corestandards.org/ELA-Literacy/W/4/1/d/) Provide a concluding statement or section related to the opinion presented.  [CCSS.ELA-Literacy.W.4.7](http://www.corestandards.org/ELA-Literacy/W/4/7/) Conduct short research projects that build knowledge through investigation of different aspects of a topic.  [CCSS.ELA-Literacy.W.4.10](http://www.corestandards.org/ELA-Literacy/W/4/10/) Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.  [CCSS.ELA-Literacy.W.4.6](http://www.corestandards.org/ELA-Literacy/W/4/6/) With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.  **Literature**  [CCSS.ELA-Literacy.L.4.3.a](http://www.corestandards.org/ELA-Literacy/L/4/3/a/) Choose words and phrases to convey ideas precisely.  [CCSS.ELA-Literacy.L.4.3.c](http://www.corestandards.org/ELA-Literacy/L/4/3/c/) Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion).  [CCSS.ELA-Literacy.L.4.4.a](http://www.corestandards.org/ELA-Literacy/L/4/4/a/) Use context (e.g., definitions, examples, or restatements in text) as a clue to the meaning of a word or phrase.  **Technology**  Learning Expectations 3.1 Students will use technology tools to enhance learning, increase productivity, and promote creativity.  Accomplishments 4.3.1.- Students will use technology tools to enhance learning, increase  productivity, and promote creativity.  Accomplishments 4.3.2. - Students will use productivity tools to collaborate in constructing  technology enhanced models, prepare publications, and produce other creative works.           c. Recognize that different software programs are designed for specific purposes. | | |
| **Central Focus of Unit/Learning Segment** | | |
| Students will be able to explain what force and motion is. Students will be able to tell you if the higher incline or the lower incline causes the object to move faster. They will also be able to determine the distance the object travels after the incline gets steeper by measuring how far the object traveled. | | |
| **Essential Understandings** | | **Essential Questions** |
| 1. The steeper the incline the faster and longer distance the object will travel. The lower the incline the slower the object is going to travel. 2. Stomping the stomp rocket allows that student to measure speed and distance. | | 1. How does the incline affect how an object travels? 2. How does the amount of force exerted on the stomp rocket affect how far the rocket goes? |
| **Lesson Objectives** | | |
| The learner will be able to describe factors that influence force and motion. | | |
| **Language Demands** | | |
| **Language Function & Key Learning Task**  **Language Function:** Analyze, compare/contrast  Key learning tasks  **Stomp Rocket and Incline**  Students will **analyze** how force and inclines affect how far an object moves. Students will **compare/contrast** how a small/large force affects the rocket and how far the toy truck will travel based on the incline.  **Content/Academic Vocabulary**  Force- a push or pull on an object  Gravity- heaviness or weight  Friction- the rubbing of the surface of one item against another  Motion- the act of movement  Inertia- objects in motion stay in motion, objects at rest stay at rest unless acted on by an outside    force.  Speed- a measurement of distance over time  Incline- a slope or gradient.  **Discourse & Syntax**   * Discourse- Students will be able to take the information they collected from the experiments from either the stomp rocket or incline activity and make a Google Doc or a Smore flyer. Students will take pictures during the activity and then upload the pictures to either Smore or Google Docs. Then they will write a reflection of what happened during the activity and include a chart of the data they collected. Students will also have to use their vocabulary words to describe what happened during the activity. * Syntax- Students will measure the distance the toy travels, the height of the incline, and the time it took for the toy to stop. The students will compare and contrast how far the toy traveled each time the incline increased. After collecting data the students will make a graph to show the data they collected.   **Supports**   1. The students will use the change of incline height and speed activity to analyze, and graph their data. 2. The students will set up and launch a stomp rocket activity and collect data of the small and large force rockets distance traveled. Then they will draw a model of what they observed and label what happened with their vocabulary words.   Modeling | | |
| **Materials/Resources** | | |
| **Teacher**   * Camera * Computer * Document camera * Projector | **Students**   * Paper * Pencil * Ruler * Cardboard * Toy car * 3-4 books * Stomp rocket kit * Think-Pair-Share worksheet * Changes of Incline Height and Speed activity worksheet. * Drawing a Force worksheet * Interactive Notebook * Construction paper for foldable * Computers/Ipads | |
| **References** | | |
| * Teacher Spaces- Haywood Elementary- used for vocabulary words   <http://r.search.yahoo.com/_ylt=A0LEVvMvtSVVFycAPw4nnIlQ;_ylu=X3oDMTByMG04Z2o2BHNlYwNzcgRwb3MDMQRjb2xvA2JmMQR2dGlkAw--/RV=2/RE=1428563376/RO=10/RU=http%3a%2f%2fteacher.haywood.k12.nc.us%2fmwilliamson%2ffiles%2f2011%2f04%2fForces-and-Motion-Vocabulary-Words2.doc/RK=0/RS=pme_Ap7TvNEDirA3tFR0i18Gmng->   * YouTube Set/Hook/Motivator <https://www.youtube.com/watch?v=LEs9J2IQIZY> * Common Misconceptions <http://www.physicsfirstmo.org/files/Misconceptions.pdf> * Common Misconceptions <http://apa.org/education/k12/alternative-conceptions.aspx> * Common Misconceptions <http://amasci.com/miscon/opphys.html> | | |
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| **Adaptations to Meet Individual Needs** |
| High-Level Learners: These students will be provided directions and materials to complete the incline setting with cars to see the distance and time traveled with much teacher direction. High level learners will be ask to find ways to change the incline. They will then be ask to chart their findings on the different objects observed.  On-Level Learners: This lesson plan is structured for the on level learners.  Struggling Learners: These students will be paired with high-level learners to assist with the struggling learner. The teacher should allow extra time for one-on-one time or small group with these students.  English Language Learner: These students will be grouped with other students and objects will be labeled to identify what they are for these students. |
| **Management/Safety Issues** |
| Instruction and rules will be made clear before any portion of the activity begins. The rules will clearly state that they materials are “tools” not “toys”. |
| **Rationale/Theoretical Reasoning** |
| **Rationale**   * Many students think that if an object is moving, then there is a force acting on it. There is a strong belief that a force must be constantly applied in order for motion, including constant speed, to continue (Gunstone and Watts 1985). * Some students tend to think of force as a property of an object, rather than an interaction between objects (Brown and Clement 1989; Dykstra, Boyle, and Monarch 1992). * Some students think that forces get things moving but do not stop things (Minstrell 1989). Some students think things stop when the force or energy in the object runs out (Driver et al. 1994). * A common belief among students of all ages is that all objects eventually slow down and stop (Driver et al. 1994). * Some students think force is transferred from one object to another (Brown and Clement 1989).   *Uncovering Student Ideas in Physical Science page 81*  **Theory**   * Students are provided an opportunity to socially construct knowledge while working with their peers. They also have the opportunity to work in their zone of proximal development. (Vygotsky, 1978)   **Common Misconceptions or Difficulties**   1. Students regard objects at rest as being in a natural state in which no forces are acting on the object. 2. Only animate objects can exert a force. Thus, if an object is at rest on a table, no forces are acting upon it. 3. A moving object stops when it’s force is used up. |
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| **Assessment/Evaluation Criteria** |
| **Formative Assessment**   1. Students will complete a Think Pair-Share chart in groups of two.They will answer the following four questions: What is force?, What is motion?, How does the amount of force exerted on an object affect the way it moves?, and How does the height of a ramp affect how fast an object rolls down it? The students will write down each question, what they think about each question, what their partner thinks about each question, and what they will share as their response for each question. 2. Students will use a piece of cardboard and several books to change the height of the incline. After they have set the incline they will measure the height and time the toy car rolling down the incline. After the truck stops they will measure the distance the truck traveled and document it on the given data chart. They will change the height of the incline four times and have five trial for each height and then average the distance traveled and the time it took the car to stop. Students will use the gathered data from the changes in incline height and speed activity and graph the data they found in their interactive notebooks. The findings in this activity will help students discover how the incline affects the speed and the distance of the toy truck. 3. Students will set up the stomp rocket activity and then apply a small and large force and measure the distance the rocket traveled. They will apply the small and large force four times and record the distance traveled each time. They will collect data on the given chart and then draw and label in their interactive notebooks what they observed during the Stomp rocket activity. 4. Students will be given a piece or construction paper to make a vocabulary foldable. After the foldable is constructed we will go over the vocabulary words as a class. The students will write down the word and its definition on the foldable.   **Summative Assessment**  Students will draw a picture of an object being acted on by a force. After the student finishes their drawing they have to describe what is happening in the picture they drew using their vocabulary words. I will then read each student's written portion of this assignment and make sure that they clearly understand what force and motion are. Students will make a Google Doc or a Smore page in small groups based on either the incline activity or the stomp rocket activity. Each student in the group should do an individual piece of the assignment. The students will be graded on the content based on a checklist of items that should be included in the piece. I will look at each Google Doc or Smore page and write down what they could have explained more or what they need to change and hand back to the students. Students need to make at least 80% on the Google Doc or Smore project page.  **Academic Feedback**  I will make close observations as the students work in pairs on their Think Pair-Share chart. I will be listening as the students talk in groups and make sure they are staying on task and helping with any questions they might have. I will provide guiding questions and assistance to the students who are struggling to do their Changes of Incline Height and Speed activity to make sure they are properly documenting their data and providing help with measuring if I need to. I will also be walking around making sure that the students properly document their Stomp Rocket activity in their interactive notebooks. I will also provide the students with help putting pictures on the computer to make either their Google Doc or their Smore technology activity. I will grade the Google Doc or Smore activity based on a checklist. Students need to score at least an 80% mastery. I will print off a blank rubric for each group’s Google Doc or Smore page and write down what they need to work on and what they got correct. I will let them know what they need to improve or further explain better. |

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| **Instruction** | **Higher-Order Thinking Questions** |
| **Set/Hook/Motivator (Before)**  **Engage:**  Part I. I show the students the gravity and force YouTube video. (3 minutes)  We will then go over our vocabulary. Students will write down their vocabulary words and definitions using a foldable. (10 minutes)  After the going over the vocabulary, I will hand out the Think Pair-Share worksheet and ask the students what kind is force, If you are sitting still is there a force acting on you,  how does the amount of force exerted on an object affect the way it moves, how does the height of the ramp affect how fast an object rolls down it? Students will then answer all four of the questions on the Think Pair-Share worksheet individually and then break into pairs to discuss what they think and then each pair will share with the class what they think the answer is to the four questions. We will then discuss the four questions as a whole group. We will collectively come to an answer everyone likes for each question that I will write down on the board and the students will fill in on their Think Pair-Share worksheet. Students will then put the worksheet into their interactive notebooks.  (20 min.) | **Application:**  What is force?  What is motion?  How does the amount of force exerted on an object affect the way it moves?  How does the height of the ramp affect how fast an object rolls down it? |
| **Instructional Procedures (During)**  **Explore:**  Students will use classroom books, incline, and cars to see how the incline affects the speed of the car which is the distance divided by time. Students will measure the distance from the starting point of the car to the front bumper of the car where it stopped after traveling down the incline. (20 minutes)  Students will set up the stomp rocket activity to see how a large and small force affects the distance the stomp rocket travels. Students will use a measuring wheel to measure the distance of the small force and large force rockets traveled. The students will do four trials for the small force and the large force rockets. (25 minutes)    **Explain:**  After the students finish both activities they will sit down and we will discuss as a whole class what they observed during both of the activities. (10 minutes)  After the discussion the students will be given a checklist and asked to complete their Google Doc or Smore activity based on what they learned from the two activities they just completed in class. The requirements for the Google Doc or Smore activity will be provided on a checklist that I will hand out to each group. Students will work in small groups to make a Smore page or Google Doc by adding pictures from either the stomp rocket or incline activity. Students will write a reflection of what happened in the activity. (30 minutes)  **Extend:**  Ask students to extend their learning by exploring how they can change the toy truck to make it travel faster/slower or shorter/longer distance. Also ask students what they can do without changing the truck or the incline to make the toy truck move faster/slower.   (20 minutes) | Explore- **Application:** How do the different inclines affect the speed of the car?      Explore- **Application:** What are the forces that you can use to make the stomp rocket travel higher?    Explain- **Analysis:** What can you infer about how force and motion works in your observations?    **Extend:**  Can you change anything to the toy truck in the Changing Incline Height and Speed activity to make it travel faster without moving the cardboard any higher or lower?  Also can you figure out anything you can do without changing the toy truck or the incline that might make the toy truck move faster/slower? |
| **Closure (After)**  **Evaluate:**  Asks students to fill out “Drawing a Force” worksheet. (10 min.)   * They will draw a picture of the object being acted on by a force. * Students will explain what is happening in the drawing by using vocabulary words from the lesson to show their understanding. |  |